Public Libraries' Perceptions of Future Collaborations for the Development of Smart Cities and Communities: Understanding Influential Factors

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Abstract

Recently, the concept of smart city has been adopted by many communities as a strategy to find alternative solutions to increasingly complex social, economic, and environmental issues. Different local actors, including public libraries, are already playing an important role in developing smart cities and communities either by themselves or in collaboration with other organizations. However, most public libraries are not currently collaborating for smart community development. Therefore, this paper analyzes the factors that influence public libraries' perceptions about future collaborations in developing smart cities and communities as well as their potential benefits. The results show that consequential incentives, the nature of the task, preexisting relationships, an agreement on initial aims, and a collaborative and supportive leader all have a significant positive impact on the extent, effectiveness, and benefits of public libraries' future collaborations to develop smart cities and communities.

1. Introduction

With increasing challenges in community development, the concept of smart city has emerged and been adopted by many cities as a strategy to explore alternative solutions to address community issues, boost economic development, improve quality of life, achieve sustainable development and, overall, make cities smarter [1]. Currently, even though there is still no consensus on the definition of smart city, it seems that there is an agreement that smart city is a multidimensional and multifaceted concept [2][3][4].

Several frameworks have been proposed to capture the different dimensions of a smart city [2] [3]. For example, Giffinger et al [5] designed six dimensions to rank 70 European cities: smart economy (competitiveness), smart people (human and social capital), smart governance (participation), smart mobility (transport and ICT), smart environment (natural resources), and smart living (quality of life). Based on a review of academic literature and practical tools, Gil-Garcia and his colleagues [4] also proposed a comprehensive conceptualization of smart city in which they not only propose the main components, but also specify the elements in these ten main components: 1) ICT and other technologies, 2) data and information, 3) natural environment and ecological sustainability, 4) built environment and city infrastructure, 5) knowledge economy and pro-business environment, 6) human capital and creativity, 7) governance, engagement and collaboration, 8) institutional arrangements, 9) city administration and management, and 10) public services. Based on various definitions and frameworks, a common view can be drawn, which is that smart city is a city that adopts a comprehensive view and integrates a double perspective; technology and human development, to pursue a triple goal [6][7]: 1) improvement in the efficiency of urban operations, 2) improvement in citizens' quality of life and 3) development of the local economy while maintaining the environmental sustainability.

The development of smartness is not limited to the urban environment. The smart community movement started in the late 1990s [2]. Recently, more discussions about smart communities have appeared in both academic and practitioner-oriented outlets [2][6]. For example, Nam and Pardo [2] defined a smart community as "a community broadly ranging from a small neighborhood to a nation-wide community of common or shared interest, whose members, organizations and governing institutions are working in partnership to use

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IT to transform their circumstances in significant ways" [2, pp. 286]. Coe et al [8] discussed the components of smart communities, including geography (proximity), technology (networking and connectivity), collective intelligence (mobilization), and social learning (continuous learning).

The development of smart cities and communities is frequently driven by information and communication technologies, but also relies on the engagement of various stakeholders to form collaborative efforts, including governments, private companies, academic institutions, and civil society [9]. For decades, public libraries have been viewed as necessary partners in community development by urban planning research [10][11][12]. In the context of a smart city, public libraries, as community anchor institutions, are currently or have great potential to provide technology access and use, facilitate citizen participation, and offer an innovation environment that contribute to developing smart cities and communities [13][14]. However, there is limited discussion in existing research about public libraries being an important partner that are involved in collaborations with local governments and other community organizations in developing smart cities and communities [15].

In addition, based on our recent national survey, it seems clear that many public libraries are contributing to the development of smart cities and communities without collaborating with other organizations or, frequently, they do not see that what they are doing is contributing to smart cities and communities. Therefore, it would be important to understand the factors that affect future collaborations between public libraries, local governments, and other community actors with the objective to contribute to smart cities and communities. This study will focus on public libraries that are not currently collaborating and investigate what factors affect the extent, effectiveness, and benefits of public libraries' future collaboration in developing smart cities and communities.

This paper is organized into six sections, including the foregoing introduction. Section two presents our review of existing literature, which includes three conceptual models of factors related to public libraries' perceptions on their future collaboration in developing smart cities and communities and presents the hypotheses of this study. Section three briefly describes the research approach used in this paper, including the design and administration of a national survey to public libraries across the United States. The section also provides some details about the survey responses and our analysis approach. Section four presents our main results as a regression analysis on the impact of multiple factors on public libraries' perceptions on the extent of future collaborations, their effectiveness, and their main benefits in developing smart cities and communities. Section five discusses some of our main findings and compares them with previous research. Finally, section six presents some concluding remarks and ideas for future research about this topic.

2. Factors influencing public libraries' future collaborations in developing smart cities and communities

Since the literature about public libraries collaborating in the context of smart cities and communities is limited, and to develop a solid understanding, our literature review included broader research about collaboration. Among these studies, the definition of collaboration varies by authors. In this study, we will adopt the definition by [16], which views cross-sector collaboration "as the linking or sharing of information, resources, activities, and capabilities by organizations in two or more sectors to achieve jointly an outcome that could not be achieved by organizations in one sector separately" [16, pp. 44]. There are different methods to evaluate collaborations. The number of collaborative partners is one of the determinants of the governance structure of the collaboration [17]. Re-evaluation measures the effectiveness of the process of collaboration [18]. The final outcome of collaboration is usually assessed using value creation and goal achievement as indicators, which refers to "the transitory and enduring benefits relative to the costs that are generated due to the interaction of the collaborators and that accrue to organizations, individuals and society" [19, pp. 727] and attaining general and specific goals of each public sector agency due to collaboration [18][20].

In the past decade, many frameworks about cross-sector collaboration have been published with listing various factors that affect the establishment, process, structure, and outcome of the collaboration [16][17][20][21][22][23][24]. Since this study mainly focuses on public libraries that have not yet been involved in any collaboration to develop smart cities and communities, the goal is to investigate the influence of factors on their perceptions on the extent, effectiveness, and benefits of their future collaborations in developing smart cities and communities. In order to achieve this research goal, the factors included in our model are the initial condition, drivers and linking mechanisms of collaboration that are frequently mentioned in previous studies [20][21][24][25]. They are: 1) consequential incentives; 2) nature of the task; 3) preexisting relationship; 4) an agreement on initial aims; and 5) a collaborative and supportive leader. Figures 1-3 show the conceptual model that guides our study.

Consequential incentives refer to either internal or external drivers for collaborative action [17][26]. The internal drivers for collaboration usually occur when organizations notice that collaboration is needed since there are serious problems that need to be addressed, there is a lack of resources, or there are opportunities for better solutions [16][26].

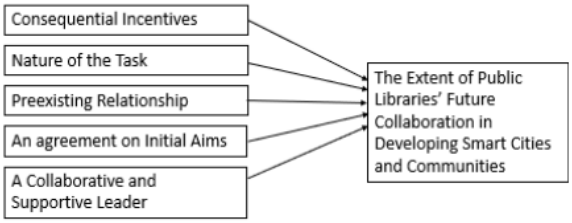

Figure 1. Influential factors of the extent of public libraries' future collaboration in developing smart cities and communities

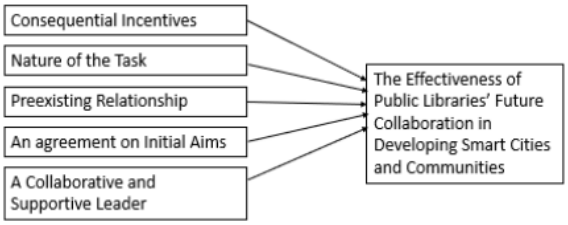

Figure 2. Influential factors of the effectiveness of public libraries' future collaboration in developing smart cities and communities

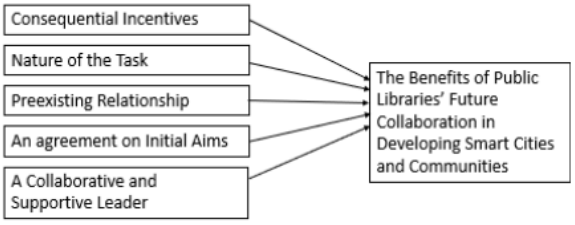

Figure 3. Influential factors of the benefits from public libraries' future collaboration in developing smart cities and communities

The external drivers are sometimes due to mandates by courts or legislatures, vulnerability of policy, political changes, or new funding opportunities [21][26]. In general, these incentives for collaboration are results of salient issues with little time but great pressure for stakeholders to find suitable solutions, or the emergence of better opportunities and funding support that are beneficial for future development [17][27]. The extent of incentives that stakeholders perceive could significantly affect the success of the collaboration; in contrast, a lack of attention to the incentives may yield a negative impact, such as organizations missing the window of opportunity to achieve better development [26]. In the development of smart cities and communities, communities have encountered significant challenges that cannot be addressed using traditional methods. Many governments have devoted a lot of funding to advocate and support collaborative efforts in community development. The increasing community issues and funding opportunities are strong incentives for collaboration in developing smart cities and communities. Based on this, we hypothesize that:

H1a. The availability of consequential incentives positively influences the extent of public libraries' future collaboration in developing smart cities and communities.

H1b. The availability of consequential incentives positively influences the effectiveness of public libraries' future collaboration in developing smart cities and communities.

H1c. The availability of consequential incentives positively influences the benefits from public libraries' future collaboration in developing smart cities and communities.

Many researchers have noted that the nature of the task to be addressed could be expected to have a significant impact on the membership, structure, and process of an interorganizational network, and ultimately affect the outcome of collaboration [20][23][28]. Organizations are more likely to develop collaboration when they are dealing with complex problems that are beyond their capabilities and need to take advantage of the capabilities and resources of others [29][30]. Simo & Bies [28], for example, explored the impact of extreme conditions, such as the Hurricane Katrina, on collaboration in disaster response. The development of smart cities and communities needs to adopt a comprehensive view of the city or community and integrates a double perspective; technology and human development, to pursue a triple goal: 1) improvement in the efficiency of urban operations, 2) improvement in citizens' quality of life and 3) development of the local economy while maintaining the environmental sustainability [6][7]. The complexity of this task cannot be fulfilled by any single organization, and its success relies on the involvement of different stakeholders that contribute to the development in different aspects of the communities [9]. Based on this, we hypothesize that:

H2a. A task that requires collaboration among multiple community organizations positively influences the extent of public libraries' future collaboration in developing smart cities and communities.

H2b. A task that requires collaboration among multiple community organizations positively influences the effectiveness of public libraries' future collaboration in developing smart cities and communities.

H2c. A task that requires collaboration among multiple community organizations positively influences the benefits from public libraries' future collaboration in developing smart cities and communities.

Preexisting relationships, also referred as the degree of structure embeddedness, plays an important role in collaboration. The quality of preexisting relationship among partners affects their trust in each other, how they perceive the legitimacy of key stakeholders and ultimately the outcome of the collaboration [16][20][26][31]. These relationships are often used by organizations as selection criteria when they look for suitable partners for collaboration [16, 20]. A prehistory of conflict or lack of prehistory of collaboration is likely to lead to low levels of trust among partners and leads to low levels of commitment and low levels of effectiveness in collaboration. On the other hand, a history of successful past collaboration can help form high levels of trust and greatly facilitate the extent and effectiveness of future collaboration [21]. Public libraries have been serving as an important partner in community development for a long time [10][11][12]. Many public libraries are departments or units of the local governments, and there is usually very close relationship between them. Public libraries also have experience collaborating with other community stakeholders, such as school district, non-profit organization, business, universities, etc. in providing various programs and services to better satisfy community needs [6]. All these preexisting relationship between public libraries and other organizations will have an impact on their future collaboration in development smart cities and communities. Based on this, we hypothesize that:

H3a. The extent of preexisting relationships positively influences the extent of public libraries' future collaboration in developing smart cities and communities.

H3b. The extent of preexisting relationships positively influences the effectiveness of public libraries' future collaboration in developing smart cities and communities.

H3c. The extent of preexisting relationships positively influences the benefits from public libraries' future collaboration in developing smart cities and communities.

Many previous frameworks about collaboration indicated that it is important to have an initial, albeit general agreement on the problem to be solved [20][26][32]. The agreement serves as a linking mechanism that helps better clarify the vision and mission of the collaboration, the role and interest that an organization has in the collaboration, and what effort it needs from other organizations to solve the problems, and ultimately contributes to the formation of the collaboration itself [16][26][29]. Furthermore, turning the agreement into authoritative texts that include mission statements, explicit norm of operation, etc. will enhance the credibility and accountability of the collaboration and help partners stay involved and committed to the collaboration [22][33]. Without this, the collaboration could be more difficult to form and less likely to be effective [33]. In many cities and communities, different stakeholders often participate in the planning stage of the smartness development, and as a result, an official smart city initiative/strategy will be developed and published to form a shared vision and mission of the development of smart cities and communities [14]. It also helps guide each stakeholder to play their roles in achieving effective collaboration in developing smart cities and communities [34]. Based on this, we hypothesize that:

H4a. An agreement on initial aims positively influences the extent of public libraries' future collaboration in developing smart cities and communities.

H4b. An agreement on initial aims positively influences the effectiveness of public libraries' future collaboration in developing smart cities and communities.

H4c. An agreement on initial aims positively influences the benefits from public libraries' future collaboration in developing smart cities and communities.

Sponsors (formal leaders, such as elected officials, heads of organizations, etc.) often provide staff, funding and favorable policy through their formal authority. Champions, as informal leaders, are usually tireless advocates and promote changes in organizations. Boundary spanners often engage in collaborative tasks and have abilities to coordinate work across organizational boundaries. These are different roles that a collaborative and supportive leader plays in helping facilitate the formation and effectiveness of collaboration [29][31][35]. Collaborative and supportive leaders have specific characteristics that enable them to embrace, empower, involve and mobilize stakeholder to move collaboration forward, which has been widely seen in research [20][26]. Leaders should have a clear understanding about problems that need to be solved and have abilities to make different partners fully be aware of the importance and relevance of the issues [30][36]. Leaders should help secure resources and help to address community issues, such as identifying and involving the right stakeholders [36]. Leaders should have collaborative mindsets, which help them keep open minded in discussion and decision making, better coordinate work within and across organizations, and equally treat every member in the collaboration to minimize the conflicts [16][27][37].

The commitment of such leaders will be very beneficial for collaboration to start off and move forward smoothly [17]. Studies have shown that a great leader is the key that helps some public libraries be proactive and become important actors and partners that contribute to developing smart cities and communities [6][13]. Based on this, we hypothesize that:

H5a. A collaborative and supportive leader positively influences the extent of public libraries' future collaboration in developing smart cities and communities.

H5b. A collaborative and supportive leader positively influences the effectiveness of public libraries' future collaboration in developing smart cities and communities.

H5c. A collaborative and supportive leader positively influences the benefits of public libraries' future collaboration in developing smart cities and communities.

3. Research approach

3.1. Survey design

The data used to test these hypotheses was collected through a survey that was designed and distributed to 8230 public library directors (from October 2020 to November 2020) and library associations in each state (from December 2002 to January 2021) across the United States. This data collection method was chosen because there are no data available from other sources that we can use to measure the variables, and a survey allows us to collect a large amount of data in a relatively short period of time. In total, we received 1254 responses.

All the independent variables are measured using scaled-response survey questions (Likert scale 1-10). The value of *consequential incentives* is the average score of its two indicators, namely the extent of community challenges and the availability of funding opportunities that support collaboration on community development. *Nature of the task* is measured by the extent of community challenges that call for collaboration among different organizations within the community. *Preexisting relationship* is measured by the extent of past collaboration between the public libraries and other organizations in community development. *An agreement on initial aims* is measured by the availability of written agreement about collaboration between the public library and other organizations in community development. *A collaborative and supportive leader* is the average score of eight indicators, including leaders' perceptions of current community issues, leader's abilities to secure resources and support to address community issues, leaders' abilities to frame community issues to make diverse partner understand the importance and relevance of the issues, the extent of leaders' commitment, leaders' collaborative mindsets, leaders' being open minded during discussion and decision making, leaders' abilities to coordinate work across departments, branches and organizations, and leaders being fair with every employee and work partners.

For the dependent variables, the *perceived effectiveness of future collaboration* is measured using scaled-response questions (Likert scale 1-10). The *perceived extent of future collaboration* is measured as the number of different types of organizations that public libraries intend to collaborate in the future in developing smart cities and communities. The *perceived benefits of future collaboration* are measured as the number of different potential benefits that public libraries think they will obtain through their future collaboration with other organizations in developing smart cities and communities.

To increase the content validity of our constructs, we developed them based on our review of previous studies. Before we distributed the survey, we also conducted two pre-tests and one pilot test with 5% of the sample (N=433) in order to increase the content validity but also the reliability of the measures and adjusted the survey content and administration process accordingly. In order to avoid the common method bias, we keep the anonymity of the respondents and also separated the questions related to the independent and dependent variables to avoid respondents figuring out the intention of the researchers [38].

3.2. Sample and method

From the 1254 responses we received, 701 of them are public libraries that have not yet collaborated with other organizations in developing smart cities and communities. This study includes those 701 responses in our analysis. The multiple imputation technique was used to address missing data in the scale-response questions. Among the respondents of the survey, the majority (91.13%) of them are public library directors, and their average working experience is about 11 years.

Among the public libraries included in this study, more than half (52.38%) of them were established between the year of 1901 to 1950. About eighty percent (78.89%) of them have one central library with no branches or bookmobiles. About forty percent (38.14%) of them serve the community with a population less than 5000. Almost sixty-five percent (64.62%) of them have less than 10 full time employees, about seventy-two percent of them (71.75%) have less than 10 part-time employees, and about half (49.07%) of them do not have

Table 1. Descriptive statistics of independent and dependent variables

Variables (N=701)	Mean	Std. dev.
Extent of future collaboration	4.500	2.634
Effectiveness of future collaboration	5.940	2.057
Benefits of future collaboration	6.080	3.606
Consequential incentives	5.867	1.747
Nature of the task	7.370	2.170
Preexisting relationship	5.770	2.847
An agreement on initial aims	3.480	2.282
A collaborative and support leader	6.990	1.998

volunteers to support the operation of the public libraries. About forty percent (37.13%) of the public libraries have an annual budget between 0.1 million to 0.5 million dollars, and about half (50.99%) of them have devoted less than ten percent of their annual budget to purchase and update the technology in the public libraries. It is worth mentioning that the pandemic in 2020 has negatively affected the number of public libraries' staff and volunteers and the availability of resources for their annual budget.

About the current technology in the public libraries, about sixty percent (56.8%) of the public libraries offer less than 10 public access computers. About half (47.93%) of the public libraries have computers that are less than 3 years old. About eighty-three percent (82.83%) of these computers have Internet connection. Almost all (99.86%) of these public libraries also offer Wi-Fi Internet access to their patrons. Among these public libraries, the top three most offered technologies are 1) Color printer (86.26%), 2) Scanners (81.29%) and Early learning technologies (e.g., AWE or table computers dedicated to pre-K) (41.81%).

Multiple regression was adopted as the analysis technique since it fits our research goal which is to examine the relationship between a single outcome (in this case, the extent, effectiveness and benefits of collaboration as the outcome of three different models) and several predictors (consequential incentives; nature of the task; preexisting relationship; an agreement on initial aims; and a collaborative and supportive leader). Before hypothesis testing, all the related assumptions were checked, including linear relationship between the independent variables and each of the dependent variables, independence of errors, multicollinearity, normality, and homoscedasticity of the errors.

4. Results

Table 1 shows the descriptive analysis of the independent and dependent variables we included in this study. We can see that for the dependent variables, public libraries' perceptions of the benefits of future collaboration in developing smart cities and communities has the highest average value, it means that many public libraries think that many benefits can be obtained through their future collaboration in developing smart cities and communities. In the meantime, this same variable also has the highest standard deviation, which means that among public libraries' perceptions on the extent, the effectiveness and the benefits of future collaboration, the perceptions on the benefits vary the most among all the public libraries included in this study. For the independent variables, the nature of the task has the highest average value, which indicates that most public libraries think that the community development challenges that they encountered call for collaboration among different organizations within the communities. In contrast, the agreement on initial aims has the lowest average value, which indicates that in many communities, written agreements about the collaboration between public libraries and other organizations on city/community development are not often available. Tables 2-4 summarize the results of the multiple regression.

We can see that in the model of the extent of future collaboration, 41% of the variance in public libraries' perceptions of the extent of future collaboration in developing smart cities and communities can be explained by all the factors included in the model, once adjusting for the number of independent variables. Looking at the impact of each individual factor, the results show consequential incentives (β=.113, p=.003), the nature of the task (β=.084, p=.033), preexisting relationships (β=.111, p=.005), and a collaborative and supportive leader (β=.451, p<.001) all have a significant positive impact on public libraries' perceptions of the extent of future collaboration in developing smart cities and communities. Overall, hypotheses 1a, 2a, 3a and 5a are supported by the data from this study.

In the model of the effectiveness of future collaboration, 46.8% of the variance in public libraries' perceptions of the effectiveness of future collaboration in developing smart cities and communities can be explained by all the factors included in the model, once adjusting for the number of variables. Looking at the impact of each individual factor, the results show that the nature of the task (β=.131, p<.001), preexisting

Table 2. Results of regression analysis: extent of future public libraries' collaboration

	Unstandardized Coefficients		Standardized Coefficients	
	B	Std. Error	Beta	Sig.
(Constant)	-2.043	.327		.000
Consequential incentives	.171	.057	.113	.003**
Nature of the task	.1102	.048	.084	.033**
Preexisting relationship	1.02	.036	.111	.005**
An agreement on initial aims	.012	.039	.011	.756
A collaborative and supportive leader	.594	.054	.451	.000***
R^2	.414			
Adjusted R^2	.410			

Note: *p < .10, **p <.05, ***p <.01

Table 3. Results of regression analysis: effectiveness of public libraries' collaboration

	Unstandardized Coefficients		Standardized Coefficients	
	B	Std. Error	Beta	Sig.
(Constant)	.677	.242		.005
Consequential incentives	.027	.042	.023	.518
Nature of the task	.125	.036	.131	.000***
Preexisting relationship	.093	.027	.129	.001**
An agreement on initial aims	.057	.029	.063	.051*
A collaborative and supportive leader	.495	.040	.481	.000***
R^2	.472			
Adjusted R^2	.468			

Note: *p < .10, **p <.05, ***p <.01

Table 4. Results of regression analysis: benefits of public libraries' collaboration

	Unstandardized Coefficients		Standardized Coefficients	
	B	Std. Error	Beta	Sig.
(Constant)	-3.042	.454		.000
Consequential incentives	.180	.079	.087	.022**
Nature of the task	.379	.067	.228	.000***
Preexisting relationship	.033	.051	.026	.518
An agreement on initial aims	.044	.055	.028	.424
A collaborative and supportive leader	.706	.074	.391	.000***
R^2	.395			
Adjusted R^2	.391			

Note: *p < .10, **p <.05, ***p <.01

relationships (β=.129, p=.001), an agreement on initial aims (β=.063, p=.051) and a collaborative and supportive leader (β=.481, p<.001) all have a significant positive impact on public libraries' perceptions of the effectiveness of future collaboration in developing smart cities and communities. Overall, hypotheses 2b, 3b, 4b and 5b are supported by the data from this study.

In the model of the benefits of future collaboration, 39.1% of the variance in public libraries' perceptions of the benefits of future collaboration in developing smart cities and communities can be explained by all the factors included in the model, once adjusting for the number of variables. Looking at the impact of each individual factor, the result shows that consequential incentives (β=.087, p=.022), the nature of the task (β=.228, p<.001) and a collaborative and supportive leader (β=.391, p<.001) all have a significant positive impact on public libraries' perceptions of the benefits of future collaboration in developing smart cities and

communities. Overall, hypotheses 1c, 2c and 5c are supported by the data from this study.

5. Discussion

This quantitative study was conducted to understand what factors affect the extent, effectiveness, and benefits of public libraries' future collaboration in developing smart cities and communities. Based on the results of the multiple regression analysis, in the model of the extent of future collaboration, consequential incentives, the nature of the task, preexisting relationships, and the presence of a collaborative and supportive leader all show significant positive impact on public libraries' perceptions on the extent of their future collaboration in developing smart cities and communities. In the model of the effectiveness of future collaboration, the nature of the task, preexisting relationships, an agreement on initial aims, and a collaborative and supportive leader all show significant positive impact on public libraries' perceptions on the effectiveness of their future collaboration in developing smart cities and communities. In the model of the benefits of future collaboration, consequential incentives, the nature of the tasks, and a collaborative and supportive leader all show significant positive impact on public libraries' perceptions on the benefits of their future collaboration in developing smart cities and communities.

Across the three models, the nature of the task and the presence of a collaborative and supportive leader consistently show significant positive impact on public libraries' perceptions on the extent, effectiveness, and benefits of their future collaboration in developing smart cities and communities. The nature of the task usually refers to the complexity of a task. For instance, when it cannot be handled by a single organization, a collaborative effort will be needed [29] [30]. The results indicate that the complexity of the community challenges has made public libraries more willing to collaborate with other organizations in future community development and they perceive that their future collaboration in developing smart cities and communities will be effective and bring important benefits. This is consistent with previous research in which the nature of the task is expected to have a significant impact on the membership, structure, and process of an interorganizational network, and ultimately affect the outcome of that collaboration [20][23][28]. The results also show that a collaborative and supportive leader is another important factor for public libraries to be optimistic about the extent, effectiveness, and benefits of their future collaboration in developing smart cities and communities. This also aligns with previous research that had indicated that collaborative and supportive leaders with certain characteristics, such as being committed to collaboration, collaborative mindset, etc., play an important role not only in the formation of collaborative efforts, but also in achieving a successful collaboration [29][31][35].

Besides these two factors, consequential incentives are proven to have a significant positive impact on public libraries' perceptions on the extent and benefits of their future collaboration in developing smart cities and communities. In this case, the pressure from significant challenges in community development and the availability of grants and funding provide windows of opportunity that many public libraries would like to catch and to start their future collaboration with other organizations in developing smart cities and communities, through which they believe it will bring benefits to residents, to the community, to public libraries, and to their partners. This is also consistent with the conclusion made by previous research that the consequential incentives serve as internal and external drivers that make organizations recognize the necessity and benefits of collaboration and motivate them to collaborate with other organizations [17][26].

Preexisting relationships are found to have a significant positive influence on public libraries' perceptions on the extent and effectiveness of their future collaboration in developing smart cities and communities. In this case, the long history of public libraries collaborating with local governments and other community organizations in community development make them also want to continue the collaboration in developing smart cities and communities and expect that the collaborative effort will be as effective as it was in other community initiatives. This also aligns with findings of previous research that state that future collaboration among different organizations is more likely to form and operate in an effective way if there are successful previous collaboration experiences among them [21][26][31].

An agreement on initial aims only shows a significant positive impact on public libraries' perceptions on the effectiveness of their future collaboration in developing smart cities and communities. More specifically in this case, the availability of written agreements about the collaboration between public libraries and other organizations make public libraries more confident about the effectiveness of their future collaboration in developing smart cities and communities. This is consistent with statements in previous research which says that an agreement on initial aims helps partners respond more effectively about the drivers and constraints of collaboration and a formal agreement will further improve the credibility and accountability of

collaboration and makes the collaboration move forward more smoothly [20][32][33]. However, our results do not support the statement indicated by [26] about the importance of an agreement on initial aims on the establishment of a collaboration. These differences will need further examination in future research.

6. Conclusions

Public libraries are already playing or have great potential to play an important role in developing smart cities and communities. However, even though the collaboration with other organizations is very important, many public libraries have not yet participated in these collaborations. Therefore, this study analyzed what factors affect the extent, effectiveness, and benefits of public libraries' future collaboration in developing smart cities and communities.

The results show that for public libraries that have not yet collaborated with other organizations in developing smart cities and communities, consequential incentives, the nature of the task, preexisting relationships, and a collaborative and supportive leader all show significant positive impact on the extent of the future collaboration in developing smart cities and communities. The nature of the task, preexisting relationships, an agreement on initial aims and a collaborative and supportive leader all show significant positive impact on the effectiveness of the future collaboration in developing smart cities and communities. Finally, consequential incentives, the nature of the tasks, and a collaborative and supportive leader all show significant positive impact on the benefits of the future collaboration in developing smart cities and communities. Among all these factors, the nature of the task and the presence of a collaborative and supportive leader consistently show significant positive impact on the three dependent variables analyzed in this study: extent, effectiveness, and benefits of the future collaboration in developing smart cities and communities.

The findings are based on a national survey to public libraries across the United States. At least in part due to the COVID-19 situation, the response rate was not ideal. Therefore, the results should be taken with caution and further testing in different contexts would be recommended, particularly in terms of potential generalizability.

In this study, we are testing the influence of multiple factors on the extent, effectiveness and benefits of public libraries' future collaboration through three multiple regression analysis. For future study, the interrelationships among these three dependent variables could also be explore. In the development of smart cities and communities, there are opportunities for public libraries to collaborate with different types of organizations. Future research should also test if the results are the same or different when focusing on collaborations with a specific type of organization (for example local government, nonprofit, private company, etc.). These additional research efforts could help us to better understand what drives public libraries to join collaborative efforts in developing smart cities and communities. In addition, besides initial drivers of collaboration, there are many other factors that affect the actual process of collaboration and ultimately affect the extent, effectiveness, and benefits of the collaboration. Future studies should be conducted to test the influence of these factors. Finally, in-depth case studies should be also conducted to better understand how and why these factors affect the extent, effectiveness, and benefits of collaboration in developing smart cities and communities in different contexts around the world.

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